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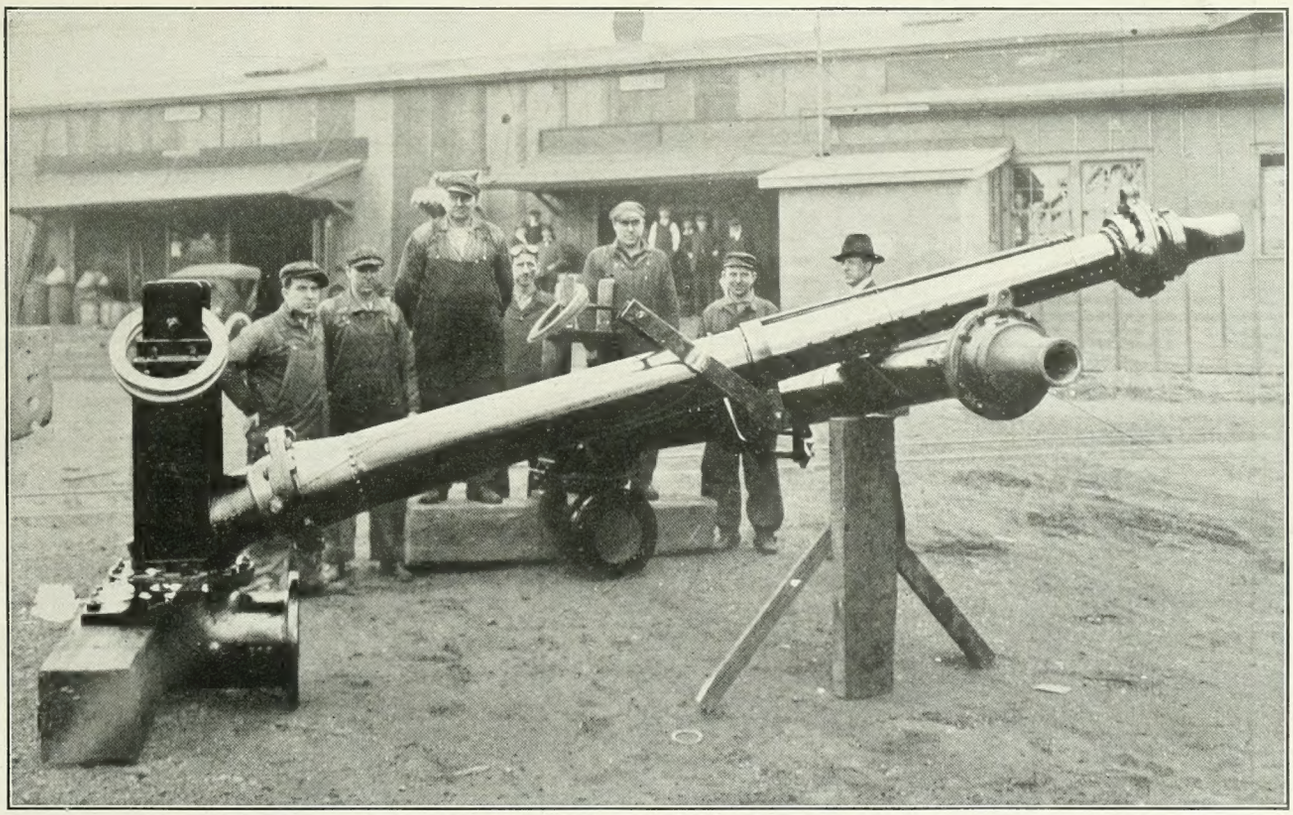
THE MIAMI CONSERVANCY BULLETIN

APRIL 1920



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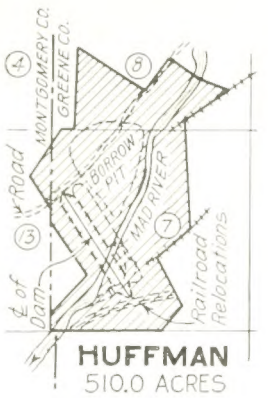
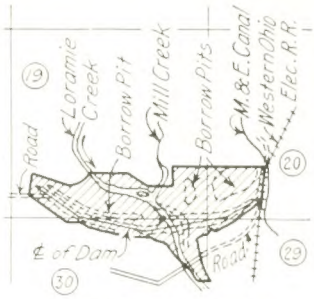
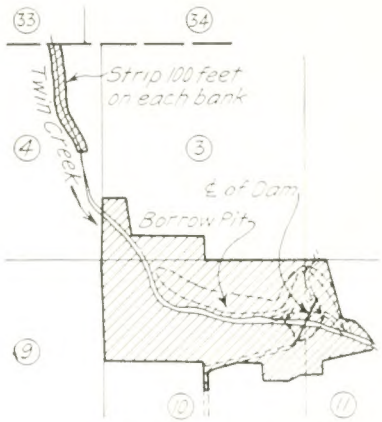


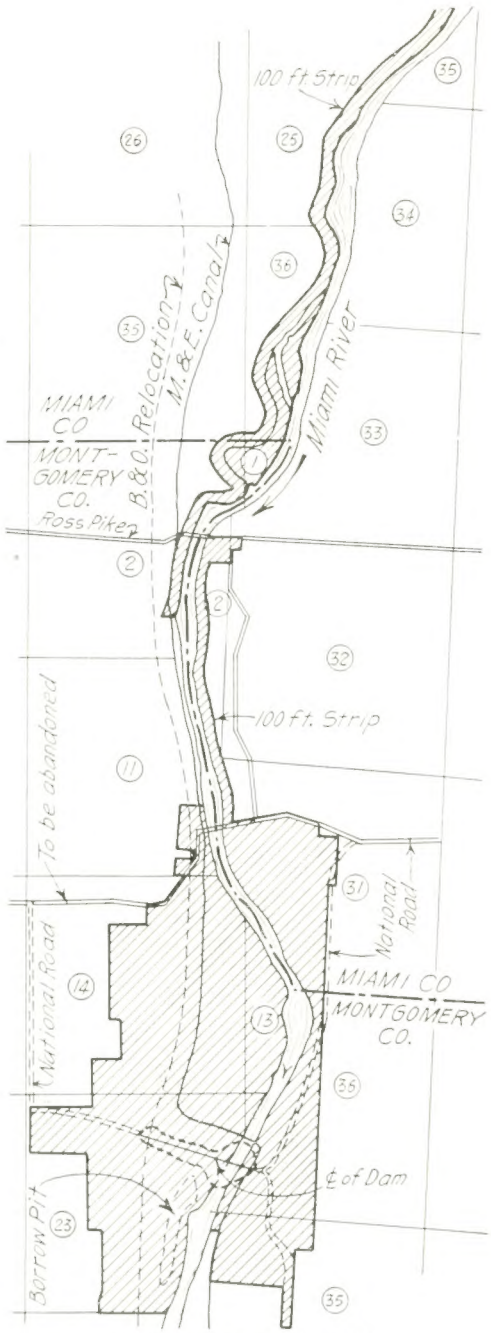
HUFFMAN
510.0 ACRES



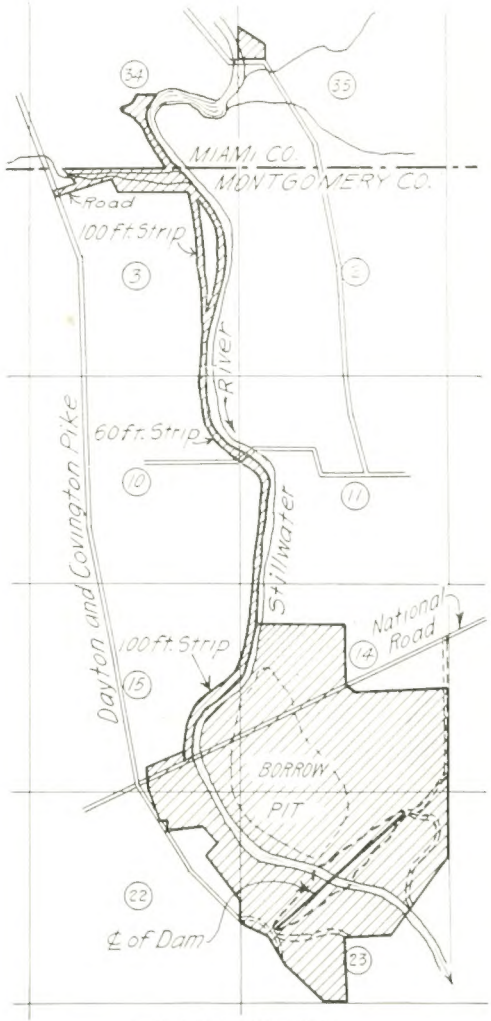
LOCKINGTON
216.3 ACRES



GERMANTOWN
461 9 ACRES



TAYLORSVILLE
1438.0 ACRES



ENGLEWOOD
829.7 ACRES

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THE
MIAMI CONSERVANCY BULLETIN
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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. **Business letters** should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to G. L. Teeple, Miami Conservancy District, Dayton, Ohio.

Work of Hydraulic Fill Resumed

Pumping operations for the work of the hydraulic fill has been resumed at all the dams except Taylorsville. The delay here is due to the necessity of waiting for the Baltimore and Ohio R. R. tracks to be moved to their new location, the hydraulic fill being now up to the level of the old line. It is hoped that within a month the pumping at Taylorsville also will be again in full swing. Huffman was the first job to get under way, the pumping there being begun on March 2, with both day and night shifts. At Lockington it was begun on the 15th, at Englewood on the 18th, and at Germantown on the 22nd. At Englewood the pumping is into the pool at the uncompleted east end of the dam, and is done from Sump No. 2. (See Fig. 103 in last Bulletin). The river section, carrying up the fill from the old bed of the Stillwater, will be begun soon. At Germantown the closure of the valley is already complete, and the embankment up to 1913 flood level. The fill here is likely to be completed by December of the present season. At Lockington also the same is probable. The fill at Lockington is now being pumped into the middle section of the embankment, next west of the outlet structure. The west end being already up to full elevation, leaves the east section the last to be done. At Huffman the pumping is into the section northwest of the diversion channel which was dug to carry Mad River while the outlet structure was being built, this channel being a few hundred feet northwest of the old bed. At Taylorsville the pumping will be into the section between the Miami River and the old B. and O. R. R. tracks. Consultation of the plans of the dams given in the Bulletin for July, 1919, will make the pumping program for the season, as given, quite clear.

Railway Construction Nearly Finished

The opening of the new season finds the work on the railway relocations in its last stages. The laying of the new rail on the steam roads—the Baltimore and Ohio, the Erie and the Big Four—has been finished. On the Ohio Electric it has been finished from Dayton to Fairfield. All the above has been done by Roberts Brothers of Chicago, the O. E. R. R. work being under the Walsh Construction Co., of Davenport, Iowa. Ballasting of the Baltimore and Ohio is complete except the final surfacing and lining, which was postponed until spring to avoid difficulties due to such work in freezing weather. Roberts Brothers are just beginning this final stage, and trains will probably be running on the new line within three weeks. Ballasting on the Big Four and Erie is under way and will be finished and the new lines turned over to these roads within three months. On the Ohio Electric the same is true as far north from Dayton as Fairfield. North of Fairfield the new track will be laid with rail taken up from the old line south of that point, there being enough of such rail in excellent condition for the purpose. Bridges on all the lines are practically finished except the new bridge for the Ohio Electric over Mad River. The contract for this has been let to The Brookville Bridge Co., of Brookville, Ohio, and the structure will be erected the coming season. This will be a Pratt truss of 150 foot span. The 3-hinged concrete arch carrying the Springfield Pike over the relocated railways at Huffman dam is complete except the hand rails. The approaches have been graded but not yet gravelled. This bridge is similar to the structure over the B. and O. R. R. at the Taylorsville dam, except that the former is a skew arch instead of a straight one..

Railway Bridges and Track Material to Be Sold

In connection with the above, attention is called to the advertisement on the back outside cover of this issue. The material there referred to is now in course of being removed from the old lines of the four railways which the District has been obliged to relocate, mentioned in the preceding editorial. The bridge structures have been in use from 5 to 15 years, and are still in excellent condition. The same may be said of the greater part of the used steel rails and other track material. The attention of city and county officials and of highway commissioners and engineers, as well as officials of steam and electric railways, is called to these materials. In the present era of high prices, they afford an unusual opportunity to obtain at moderate cost, and for early delivery, equipment which otherwise may prove difficult and expensive to get hold of.

The Conservancy Park System

The attention of the public is again called to the Conservancy Park System, referred to in the last issue, and of which a description is given in the following pages. The Board of Directors of the District has taken action to keep these lands in the public ownership, as permanent Conservancy property. This action was called for in carrying out the necessities of the flood prevention project, and such being the case, the public is to be congratulated that the lands can also be dedicated to public use and enjoyment as a park and playground, without derogation to their utility as an adjunct to the larger end. That the action of the Board will have the approval of the citizens of the state and valley, and more and more so as the years go on and the value of the parks becomes increasingly apparent, there is no reason to doubt.

Warning Against Use of Conservancy Dams for Water Power

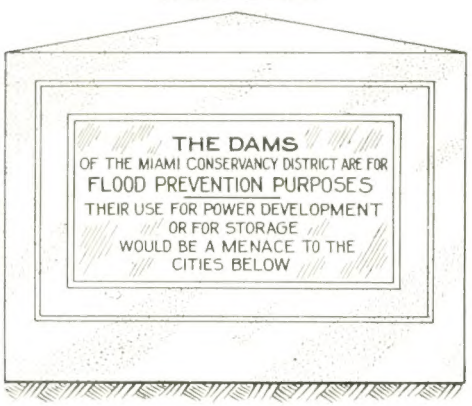

FIG. 113—MONUMENT FOR DAMS

We are breaking the regular routine of the editorial page by introducing the little cut shown above, for the purpose of once more emphasizing the fact already several times insisted upon in these columns, that the Conservancy dams have not been designed, and must never be used, for water power purposes. The cut is a reproduction of the design of the stone monument, with its description, to be erected at each of the dams, as a perpetual warning that the use of the dams for water power will constitute "a menace to the cities in the valley below." There has been in the past, and there still exists, a tendency to a persistent misunderstanding of this matter by some of the people. The monuments referred to, it is hoped, will help to give reassurance on this point, as well as warning. They are of gray Vermont granite, from the famous quarries of Barre, in that state and are now in the Conservancy warehouse awaiting shipment to the several damsites.

Cut of Conservancy Parks

It perhaps needs explanation that the cut of the Conservancy parks shown on the inside of the front cover is not one map, but an assembling on the same page of five maps, one for each dam site, drawn to the same scale for purposes of comparison. The shaded areas are the park lands as reserved. The fact that certain tracts are larger than others simply means that the needs were more extensive in the larger areas, or that favorable extensions in some cases could be made at slight expense. The scale will be given by the sections, which in most cases are one mile square, each section being numbered, the number, where possible, being at the section center. The arrow indicates the north point. The borrow pits and the dam sites are indicated by dotted lines. Except at Lockington, the borrow pit area will be occupied after construction by a lake. A road will lead across the top of each dam, along its center line, connecting with other roads of the neighborhood. At Taylorsville the present location of the National Road across the Miami Valley will be abandoned, and a new location substituted crossing the dam, as indicated on the map.

An Interesting Construction Problem

An interesting construction problem confronted the Conservancy engineers at Hamilton in the carrying of the tail race of the new Ford-Son power plant tail race under the Baltimore and Ohio R. R. bridge. The latter is a four-arch stone structure, and the tail race is built of concrete, in two branches, one passing under each of the two center arches. The excavation for the tail race had to be carried 12 feet below the foundations of the bridge piers, and the problem was to carry on the excavation and the tail race construction without danger to the stability of the piers, the bridge meanwhile carrying the full main line railway traffic. This work will be described in detail in the next number of the Bulletin.

Recording Indicators

The Conservancy engineers have found it advisable to install a number of recording instruments on the District's electrical equipment, these instruments furnishing a continuous record of current and voltage used by various motors during the twenty-four hours. These have had an excellent effect in speeding up the work, promoting efficiency and preventing waste, in some cases returning the cost of the recording apparatus in a few weeks' use. The most interesting and significant feature has been their effect on the morale of the men. Between day and night gangs on the dredge pump outfits, for example, there is the universal and perfectly honest human tendency to "pass the buck." The recording ampere-meter, put on the witness stand, tells its unimpeachable tale as to which gang was "delivering the goods." Then the other gang, its pride stirred up, "gets busy" and boosts the yardage pumped. Particulars will be given later.

The Conservancy Parks

An Area of 3455.9 Acres Has Been Reserved, Including the Chain of Small Lakes Created by the Excavation for the Dams, Constituting a Beautiful, and for Ohio a Unique, Park System.

The Conservancy Park System, recently established by the board of directors, is a happy by-product of the flood prevention work. It is desirable for the District to retain ownership and control of certain lands adjoining the dams and of other strips of land along the rivers above the dams. This being the case, the use of these retained lands for a system of parks follows naturally. That these will be beautifully wooded areas, with lakes, rivers, hills, springs and brooks, is a pleasing bit of good fortune. For the present these areas will not be developed, but kept in their natural state as a recreation ground for the people of the Valley. The future can decide what further steps may be taken.

The cut on the inside cover page shows the system as proposed. It comprises five subdivisions, one for each of the retarding basins. The acreage reserved in each case is as follows:

Germantown	461.9 acres
Englewood	829.7 "
Lockington	216.3 "
Taylorsville	1438.0 "
Huffman	510.0 "

The most notable feature will be the lakes, the more so that this region has very few such bodies of water. They occur in connection with the necessary excavation to obtain materials for the building of the dams, which are to be of earth. The total quantity necessary will run to more than 8,000,000 wagon loads. The depressions made by the excavation fill naturally with water, thus creating lakes. At Englewood, where the excavation amounts to 3,500,000 wagon loads, the lake will be three-quarters of a mile long. Its area will be above 100 acres, and it will have a shore line of six or seven miles. This lake will have a beautiful and interesting feature in the shape of what is virtually an island, of 15 to 20 acres extent, connecting with the mainland on the northeast by a peninsular strip, along which a roadway will be constructed, permitting visitors to drive directly to the island. This island, now a wooded mound in the valley bottom a little above the dam site, and on which the trees will be preserved, will be one of the finest features of the reservation.

At Huffman the lake will be about 30 acres in extent, and will also be the most attractive feature. At Germantown, it will be somewhat smaller, but beautifully located along the foot of a densely wooded hill. At Taylorsville and Lockington the

FIG. 114—CONSERVANCY PARK AT "PIG EYE CREEK"

This is about 3½ miles above the Englewood Dam; a tract about 30 acres in extent, connected with the main park at the dam by a strip of riverside wood road. A fine park area, running from the Covington Pike to the Stillwater River, including bluff, hill slope and lowland, most of which is already wooded, with trees in great variety. Taken Feb. 20, 1920.

FIG. 115—CONSERVANCY PARK—STILLWATER RIVER BANK

This is at the northern extremity of the Englewood Park, about 2 miles above Union, and 4½ miles above the dam. The riverside park drive just south of it is along a high wooded bluff, commanding a view over the valley for miles. Taken Feb. 20, 1920.

material for the dams is largely obtained from the valley slopes rather than the valley bottom, and on this account the bodies of water will be less conspicuous features.

At Englewood and Germantown the extent of the lakes will be increased by the building of low rock fills, blocking the stream just above the dam and creating artificial rapids. At Englewood this fill is being built by loading on cars the "oversize" rocks from the borrow pits, as they are screened out at the dredge pump inlet, and dumping them off the north side of the railway trestle into the river. The dams being built by the hydraulic fill method, these rocks cannot be used on the main dam embankment, because they are so large as to "stick in the throat" of the pump, and choke it. They must be got rid of somehow, and they are as cheaply dumped on the proposed rock fill as anywhere else. The effect of this fill will be to form a rapids or riffle, raising the water in the river about five feet above ordinary low water flow, thus making it run about bankful. The lake level will be raised by the same amount. This will cover up several marsh-like areas along the banks and shores, will enlarge the lake, widen the stream, and kill off mosquito-breeding pools by deepening them, all at practically no expense. The backwater effect of this artificial rapids will extend up the river about two miles. The methods and results at Germantown will be similar.

The retention of areas for considerable distances upstream from the dam is desirable for he protection of the outlet structures from floating drift in times of flood. There will be concrete piers just above the outlets for this purpose, with floating log booms anchored by chains to the piers, but to make assurance doubly sure in this particular, and to prevent the accumulation of litter during a flood, it is deemed advisable to plant drift screens of willow, cottonwood, etc., along the banks and across the valley farther upstream. For these plantings the areas reserved are necessary. The officers of the District are in consultation with the heads of the Ohio State Bureau of Forestry in reference to this project, as to the best varieties to plant, time and best manner of planting, etc. Willow, cottonwood, osage orange, sycamore and cypress are all under consideration. Several belts of these trees have been proposed, of different varieties, details regarding which will be given at a later date. How this all fits in with the park reservation project, in promoting both beauty and utility, will be evident.

The foregoing naturally leads to the consideration of the trees of the reservation. It is the wooded hillsides, with the lakes and the streams, which will give a variety and beauty to the landscape, such as no other district in Ohio can show, because no other district will have such a combination. Of the wealth of this region in trees, few who inhabit it have an adequate realization. The state of Ohio has 129 varieties of native trees. The Conservancy park reservation, (judging by the occurrence of trees in and about Dayton) has more than 80 distinct species. By contrast, consider the island of Great Britain, which has in all only 29 native species growing wild. France has only 34; Germany, (with a wider area and variety of landscape) had only 65; while the entire continent of Europe can show but 80 species, a less number than the Conservancy Parks alone will have.* An hour and a half's excursion through the Englewood reservation brought to note 45 species in that one tract. There grow about Dayton five species of maple; five of hickory; six of ash; eight

*The reasons for this greater tree wealth of America as compared with Europe are interesting. Fossil remains of the pre-glacial epoch indicate that in the earlier time Europe was as rich in tree forms as our own continent. But when, for reasons not yet fully ascertained, the great northern ice cap began slowly spreading and sliding southward toward the warmer zones, it found on the two continents quite different conditions. In Europe the advancing ice sheet (hundreds and even thousands of feet in thickness) encountered mountain ranges in its path—the Alps, the Carpathians, the Pyrenees, etc. Driving the trees of the temperate zone before it, with its polar winds and snows, it trapped them between the ice sheet and the mountain ranges, in many cases driving them up to the snow line, so that many species, unable to endure the severe conditions, perished entirely. In America no such mountain barrier interposed; the trees, fleeing before the cold, migrated southward, where they could live, and on the retreat of the glaciers, again returned to their native northern range.

of oak, and nine of haw. All these can doubtless be found in the Conservancy reservations. Considering what has been said, it will be clear that these parks will be a museum for the botanical student such as few of our states can show; if for no other reason than that few of them can show so favorable a habitat, where trees native to both the northern and the southern states can meet on a neutral ground. In this connection these reservations may well offer advantages in connection with the State Forestry Bureau, where studies may be pursued which will be of industrial and commercial advantage to the entire state.

The list below shows the species of trees and shrubs found during a short excursion in the Englewood reservation. For this list, as well as for the information regarding tree distribution herein presented, the writer is indebted to Professor William S. Werthner of the Steele High School, Dayton. The list follows: Apple, blue ash, black ash, prickly ash, white ash, basswood, beech, blue beech, box-elder, buckeye, burning bush, butternut, red cedar, black cherry, cottonwood, dogwood, American elm, slippery elm, hackberry, black haw, downy haw, pignut hickory, shellbark hickory, yellow bud hickory, hop-tree, ironwood, flowering locust, honey locust, silver maple, sugar maple, red mulberry, bur oak, chestnut oak, red oak, white oak, osage orange, papaw, wild plum, redbud, smooth sumach, sycamore, tulip-tree, walnut, black willow.

The following additional species are also known to occur in the Englewood Park: Catalpa, choke cherry, red maple, white mulberry, black oak, persimmon, sassafras, hairy sumach.

It should be noted, as regards the individual parks of the proposed system, that each has features which make it different from the others, and give it an interest of its own. At Germantown the high wooded bank on the south side of the valley will extend for a mile above the dam, with fine trees in great variety. Fig. 116 shows a view of one bit of this bank. The north bank, which has suffered from the cutting off of timber which should have been left standing, will be restored, and in time will be as attractive as the south bank. Between the two there will be a narrow lake a half mile in length, with wooded shores and stocked with black bass and trout, where the fisherman can get back again to the wild. Brooks of spring water, which never run dry, come down from the hill slopes on each side, through copses of red bud, dogwood, haw, wild apple, and other shrubs. In the character indicated—that of a long, narrow lake between high wooded bluffs—the Germantown park can be made unique, a bit of real "primeval wildnerness" hidden among the farms.

FIG. 116—CONSERVANCY PARK HILLSIDE AT GERMANTOWN DAM

This is the hill slope rising from the south bank of Twin Creek. The valley bottom here will be occupied by a narrow lake half a mile long, lying between high wooded shores. The waters, fed by brooks heading in perpetual springs, will be stocked with bass and trout. This lake can be made one of the most beautiful spots in Ohio. Taken Jan. 10, 1919.

At Englewood, as has been said, the lake will be the outstanding feature, with several islands, and the large peninsular headland already mentioned, giving variety to its surface. Here also, on th west shore, between the National Road and the dam,

there is a stretch of the original forest. Above the lake, a strip of park will run along the west bank of the Stillwater north to the Miami County line. Here a tract of about thirty acres, extending west to the Covington Pike, has been purchased, lying along the course of the un-euphoneous but picturesque streamlet known as "Pig-Eye Creek." ("Pig-Eye" translated into Iroquois, will no doubt sound as attractive as the little valley itself is). This area is wooded, fed by perpetual springs, and rightly developed, will make one of the prettiest spots in the Miami Valley. A road is planned to be built along the west bank of the Stillwater, extending the entire length of the reservation. This, however, will be left to future authorities to carry out. An old mill and mill race, with a concrete dam, a little below "Pig-Eye," offer further possibilities of development. For a half mile above "Pig-Eye" the streamside road will run along a high wooded bluff, offering a view across the valley for miles. The rock riffle above the Englewood dam has been already mentioned. The water, foaming down this rock rapids, will make a picturesque addition to the landscape.

At Lockington all the land around the dam which the District now owns will be retained. This includes the wooded bluff to the northwest of the main dam. The park area here is compact, and includes a lake which will be quite small, the borrow pit at Lockington being for the most part on the east valley slope.

At Taylorsville the reservation will include all the land acquired by the Conservancy south of the National Road, a strip nearly two miles in length, (north and south) and a mile in width. This includes several exceptionally fine pieces of forest, especially near the west end of the dam, to the north and the south of it. North of the National Road the reservation continues as a strip bordering the river, along which a road is planned, for a distance of about four miles and a half. The drive here, with vistas of meadow, woodland and valley slope, will be especially attractive. For reasons similar to those at Lockington, the lake at Taylorsville will be small—a few acres lying just south of the dam.

At Huffman the lake will be larger than anywhere else except at Englewood—a broad sheet of water about thirty acres in extent, with its east bank wooded. The fine wooded hilltop at the south end of the dam site is included; also the wooded hillside at the north end; and the woods on the valley bottom through which the river now runs. The Huffman park will thus exhibit the character of a broad, level expanse of wood and meadow, with a lake as its focal "eye," with high, wooded slopes rising along its borders to the north and south, and enclosed on the west by the green, grassy slope of the dam embankment.

Unique features of the lake park system, as planned, will be the big concrete swimming pools just below the dam embankments. These are the "hydraulic jump pools" of the outlet structures, and are essential features of the flood prevention plans. It may be reckoned a piece of good fortune that these pools can thus be made to contribute to the general scheme of a park and recreation system. At Taylorsville especially the pool will be an imposing affair—a great concrete basin 200 feet wide and 200 feet in length, opening fanwise out of the four tunnels through which the river pours, with high walls at each side, and the great concrete apron of the "spillway," with its massive side walls, rising to the crest of the dam in front. The depth of water at ordinary flow will vary, as one descends the concrete "stairway" leading down from the tunnels to the bottom of the pool, from five feet as a minimum, to a maximum of thirty-one feet. The side walls will furnish a "high dive" of almost any depth and dizziness the swimmer can desire.

The possibility of keeping the lakes at the various dam sites stocked with fish has been already mentioned. By collaboration with the state authorities at Columbus, this should offer no difficulty. The fishing facilities thus provided should prove a source of health and enjoyment to the people of the Valley for all the years to come.

A thoughtful consideration of what has been said will prove convincing, it is believed, as to the high value of the asset which the people of the Valley now possess in the lands about the Conservancy dams, and as to the wisdom of reserving them to future public use. Especially is this true when one considers the unique character of the result, as regards Ohio, in the chain of lakes which will be thus created. Ohio has almost no lakes. It has nowhere a chain of them such as will come into existence with the building of the Conservancy dams. It therefore behooves the commonwealth itself, no less than the Miami Valley, to see to it that the public resource thus brought into being shall be used and developed to the utmost, for the common enjoyment and the common good. As regards what is now proposed by the authorities of the District—the simple reservation of the necessary land to permit the carrying out of such a project by the people of the state and Valley, at such future time as wisdom shall indicate—there appears to be no question whatever, especially since it can be done at only trivial expense, and as an adjunct and "by-product" of the main end of flood prevention.

Notice to the Public

These park lands are now open to the public, except those parts that are occupied by tenants. As the Conservancy District cannot afford to employ caretakers, the people of the Valley should take upon themselves the responsibility for keeping the parks free from harm and abuse. Please do not destroy trees or shrubs, and please do not leave papers or lunch boxes behind.

The New Hydraulic "Giant" for Lockington Dam

Our front outside cover page shows the new "155 millimeter" gun just on the point of being shipped to the Lockington "front" for use in the borrow pit excavation there. It is 15 feet in length over all, and throws a 5-inch jet of water with a "muzzle velocity" of between 140 and 150 feet per second, varying with the head, which will be between 310 and

(Continued on Page 143)

February Progress on the Work

GERMANTOWN

Due to the repair work necessary to place the equipment and the pumping plant in good shape for the coming season's work, the dredge pumps have been forced to remain idle.

The booster station on the dam has been erected and the pump and electrical apparatus installed, so that this unit is in readiness for pumping.

Repair work on the equipment has progressed favorably, and at present is practically completed. The Lidgerwood Class K Dragline has been overhauled, the locomotives have been re-flued and the dump cars repaired. A new concrete floor has been placed in the hog box. In addition to these things there have been a number of minor repairs.

After being down for repairs the Marion dragline is again building the upstream slope of the dam.

The new track along the borrow pit has been laid and is now being installed.

Arthur L. Pauls, Division Engineer.

April 22, 1920.

ENGLEWOOD

During the past month Sump No. 2, for pumping hydraulic fill, has been completed and will be used for placing material in the dam the latter part of this week. Sump No. 3 is well along and should be ready for service by April 1. One of the scows for supporting the supply pumps and motors in the hydraulic pool during the river closure is practically completed. The approach track to Sump No. 3 is about ready for use.

Railroad tracks have been re-ballasted and lines extended. Plant has been overhauled. The electric dragline which constructed Cross Dam No. 1 has been successfully moved across the river preparatory to excavating the temporary spillway

H. S. R. McCurdy, Division Engineer.

March 15, 1920.

LOCKINGTON

After a long period of idleness, made necessary by the severe winter weather, the dredge pumps resumd operations on March 15. Material for the fill is now being taken from the western part of the borrow pit area. Sluice flumes are being placed in the pit as an improvement over the sluice ditches heretofore used for transporting the material to the dredge pumps. During the winter season a 350 H. P. motor was installed to drive one of the 12-in. pumps in place of a 250 H. P. motor which had been in service. Using this motor with a specially large diameter pump runner, will obviate, it is thought, most of the necessity for a booster pump. While the frction and other power losses in the single high pressure pump will necessarily be considerable, they will be much less than the combined losses in two pumps of less pressure, working in series to accomplish the same result.

The steam dragline is now excavating the cut-off trench east of the outlet works.

Rock surfacing has been continued on the downstream slope of the dam west of the retaining walls.

The impervious blanket covering the old river channel upstream from the dam is being placed by siphoning waste core material out of the core pool.

Barton M. Jones, Division Engineer.

March 23, 1920.

TAYLORSVILLE

The progress of the Lidgerwood Dragline on the inlet channel excavation during the last month was considerably better than for the two previous months.

The loading track on the rock berm on the east edge of the outlet works excavation has been cut off at the north end by the dragline and a connecting track between the two bridges has been laid on the cofferdam levee. This levee will be widened so as to accommodate the Lidgerwood dragline on its trip to the outlet channel after the inlet channel has been finished.

The progress on the concrete has shown considerable improvement with the let-up in the extremely cold weather. The boom on the west derrick has been cut down from 105 feet to 90 feet, which makes it faster and easier to handle. The floor of the stilling pool and the channel below it have been finished from the south end to the north weir. The south weir has been finished and the north weir is 75 per cent finished. The east wall is finished to the north weir and the west wall is finished to within 60 feet of the north weir. Five floor blocks in the hydraulic jump pool have been poured.

O. N. Floyd, Division Engineer.

March 19, 1920.

HUFFMAN

During the past month steel sheet piles have been driven along the axis of the dam, across the old bed of Mad River, in order to stop any tendency for excess seepage of water under the dam at this point.

The steam dragline is leveling and trimming to a true slope the north bank of the outlet channel below the concrete structure.

During the latter part of February, when the hydraulic pumping was shut down on account of cold weather, the 15-in. Morris dredge pump, borrowed from Taylorsville, was dismantled, and a new American Manganese pump installed as a primary unit. With this in operation the placing of embankment in the dam was resumed on March 2, with day and night shifts, the latter running continuously to date, and the day shift to March 15th, when it was necessary to discontinue day pumping on account of starting the delivery of ballast for the relocation of the railroads through the Huffman basin.

It has been found that there is a shortage of core material in the main borrow pit in the valley above the dam. Preparations are being made to sluice sufficient material from the hillside at the north end of the dam to make up this deficiency, as tests show this material contains a much larger percentage of clay and silt than that found in the valley. The upper part of this hillside borrow pit will be washed directly into the dam, and the lower part to a sump at the toe of the dam and then pumped into place. It is expected that this supplementary plant will be in operation soon after the first of April.

C. C. Chambers, Division Engineer.

March 22, 1920.

DAYTON

Erection of Dragline D-15 was completed on the first of March. A new section of work was opened up March 8, when this machine started channel excavation at the north side of Stewart Street Bridge. Dragline D-16 completed the lowering of the gas and water mains at Third Street, completed a fill of 9,000 cubic yards at Sunrise Avenue and has cut across the mouth of Wolf Creek. It is now beginning excavation for the unloading basin opposite the gravel plant. Dragline D-19 has resumed levelling off Herman Avenue spoil bank. Erection of Dragline D-8 has been completed and the machine is now casting gravel into storage on the bank at the end of Chicago Avenue.

On March 15, 1900 cubic yards of concrete had been placed in the Robert Boulevard Wall.

Up to the end of February the gravel plant had sold to outside parties 2075 cubic yards of sand and 4622 cubic yards of gravel.

Channel excavation to date amounts to 690,000 cubic yards. The total pay quantity in spoil bank and levees is 492,000 cubic yards, including 60,000 cubic yards of levee embankment on Contract 41. In accomplishing this work the total yardage handled amounts to 1,214,300 cubic yards. These figures do not include excess excavation from the launching basin and scowing channels, which amounts to 38,700 cubic yards.

C. A. Bock, Division Engineer.

March 23, 1920.

HAMILTON

The work of channel excavation was carried on at a satisfactory rate during the month of February, 53,000 cubic yards of item 9 being taken out by the electric dragline. The total yardage handled to March 1 amounted to 1,152,000 The total of item 9, channel excavation, was 623,700 cubic yards.

The electric dragline is taking out the last cut on the east side of the river between the Columbia bridge and the R. R. bridge, placing most of the material in and back of the levee, and loading the remainder on cars. The

spoil bank for the location of Price Bros.' block plant, has been filled.

The steam dragline has built a levee on the west side of the river from Ross Street to about Arch Street, and has completed the excavation for the wall at the southwest corner of the Main Street bridge. It is now moving into position for the excavation for the wall at the northwest corner of the bridge.

Price Bros. have completed the shed for their concrete block plant and are erecting a derrick to handle the gravel. They also have their pile driving apparatus in shape ready to begin driving on the trestle north of the Columbia bridge.

Concreting has been practically completed at the northeast wall with the exception of the coping.

C. H. Eiffert, Division Engineer.

March 20, 1920.

LOWER RIVER WORK

Owing to the continuance of the conditions as reported last month there has been no work done on this division during February.

F. G. Blackwell, Assistant Engineer.

March 22, 1920.

RAILWAY RELOCATION

Big Four and Erie—The tracklaying on the Big Four and Erie is now complete except for the sidetracks and the connection with the old tracks at Enon and Dayton. These will be attended to when ballasting is completed.

The Walsh Construction Company began ballasting on March 15. All ballast used on these railways will be gravel, excavated from the bed of Mad River at Huffman Dam by the District's large dragline.

The Fairfield Signal Tower is completed and the ground signal work is 60 per cent complete.

The brickwork on Tates Point Signal Tower is 50 per cent complete. The signal gang will begin ground work at this tower April 5.

The Western Union Telegraph Company's gangs have stopped work on the pole line owing to the lack of material (cross arms, etc.), but expect to resume work April 1.

Ohio Electric Railway—The tracklaying has been completed from the underpass to Fairfield. This completes the Roberts Brothers tracklaying contract in the Huffman Basin.

The Baltimore & Ohio Railroad—Roberts Brothers are starting up their Poplar Creek camp preparatory to resuming the ballasting of the track. All the ballast has been distributed.

The Baltimore & Ohio Railroad's own forces are raising the tracks south of Needmore Road. This work is now nearly complete.

Albert Larsen, Division Engineer.

March 22, 1920.

RIVER AND WEATHER CONDITIONS

The rainfall in the Miami Valley during the month of February was about two inches less than normal. The rivers were comparatively low during the entire month, although a small rise of from two to five feet was caused by the precipitation of about a half an inch which fell on the 21st.

At the District's stations the total precipitation varied from 0.21 inches at Fort Loramie to 1.36 inches at the Taylorsville Dam. At Dayton the total for the month amounted to 1.13 inches or 2.03 inches less than normal, thus increasing the accumulated deficiency since January 1 to 3.24 inches.

Observations taken by the U. S. Weather Bureau at Dayton show that the mean temperature for the month was 29.8 degrees or 1.0 degree less than normal; that there were 6 clear days, 9 partly cloudy days, 14 cloudy days, and 11 days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 11.2 miles perhour, the prevailing direction being from the northwest; and that the maximum wind velocity for five minutes was 39 miles per hour from the southwest on the 17th.

Ivan E. Houk, District Forecaster.

March 25, 1920.

Pressure Cells in Conservancy Dam Cores

Earth Pressure Cells, Installed in the Dams on the Core Center Lines and in the Edges of the Gravel Retaining Embankments, Demonstrate a Satisfactory Solidification of Core Material.

Experience has demonstrated that the point most in need of careful attention in a hydraulic fill earth dam, both in design and construction, is the core. The reasons for this are outlined on page 107 in the February Bulletin of 1920. As there shown (See Fig. 91) a hydraulic fill dam consists of three essential features—two parallel embankments of sand and gravel, extending across the valley, and a broad wall of clay and silt "sandwiched" between them, the latter known as the core or core wall. The clay wall makes the dam impervious; the sand and gravel embankments give it massiveness and stability. All three are deposited by water, and it is this fact, as will be seen, which makes the core the critical point in the design and construction—the "ham what am" of the "sandwich."

The reasons for this will be clear on considering the process as described in the article referred to. The clay and silt are deposited in the core as mud settling to the bottom of a pool of water maintained along the center line over the entire length of the embankment. Mixed with the clay and silt are considerable quantities of very fine sand, the entire material being as fine as commercial cement. This core material consolidates very slowly in the bottom of the pool. This is especially the case where the clay forms a large proportion of it. In that case the core may retain its water and remain semi-fluid for weeks and even months. Clay is the most plastic, the most impervious, and the most absorbent of water of all the materials. Being also the finest, it penetrates the spaces between the other coarser particles, swells up and if sufficient in amount corks every pore, making the material water tight as a dish pan. When it fails thus to drain itself freely, the core will remain semi-fluid for some time. In the Calaveras dam, in California, this condition persisted for more than a year.

The core of the Calaveras dam contained a very large proportion of clay, and to this circumstance, for the reasons noted above, the persistence of the semi-fluid condition is believed to be largely due. Also, at Calaveras, the proportion of core material to the sand and gravel of the two retaining embankments was very large. In both respects, the Conservancy dams offer entirely different conditions. The materials for the core contain but a relatively small proportion of clay, and they constitute but a small proportion of the entire material in the dam—not more than one-fifth to one-sixth. The latter point is secured, when necessary, by careful selection and proportion of the materials; in the main, it is secured by Nature herself, in the fortunate grading of the materials supplied in the "borrow pits." The clay also occurs naturally as a relatively small proportion of the core material, except at Taylors-

ville. There the excess clay is rejected, by permitting it to float out of the core pool with the waste water, the level of the waste pipe, to accomplish this, being lowered a little.

The facts above noted, as to grading and nature of the materials, were ascertained early in the formulation of the Conservancy plans, by securing samples of the material from other hydraulic fill dams, and studying them side by side with materials from the proposed Conservancy borrow pits. Careful study gave assurance that the hydraulic fill method, with the precautions noted in the last paragraph, would be a safe and economical method—was in fact the method which should be adopted. Nevertheless, it was deemed wise to make a further study of the core materials as they were deposited in the process of dam building; to watch, if it were possible, the process of consolidation in the core, so that it might be known absolutely that proper solidification was secured. Such a watch on core materials has never been heretofore kept in a hydraulic fill dam, and no method had ever been devised to do it, save the very crude one (at Calaveras), of sounding the pool with a six-inch cast iron ball, to see how far the ball would penetrate. Something better was wanted and the Conservancy engineers cast about to find it.

The clue was furnished by the Bureau of Public Roads in the Department of Agriculture at Washington, in its investigations as to the pressures on the concrete floors of bridges when covered over with earth fill, and subjected to loads, like those given by wagons, trucks, etc., the object of the investigations being to furnish figures to be used in bridge design. To ascertain these pressures the Department had originated (through Mr. A. T. Goldbeck) a device which would measure earth pressures in a manner analogous to measurements of steam pressure by a steam gage. It occurred to the Conservancy engineers that by applying this device, called a "pressure cell," to measure the pressures within the cores at various depths, as the dams were built up, it might be possible to arrive at a measure of the solidification of the core materials.

The reasoning in the case is briefly as follows: At any point in a fluid, the pressure of the fluid is the same in all directions. (As is illustrated by the fact that water tapped through the side of a tank will spurt with equal force—up, down or sidewise).

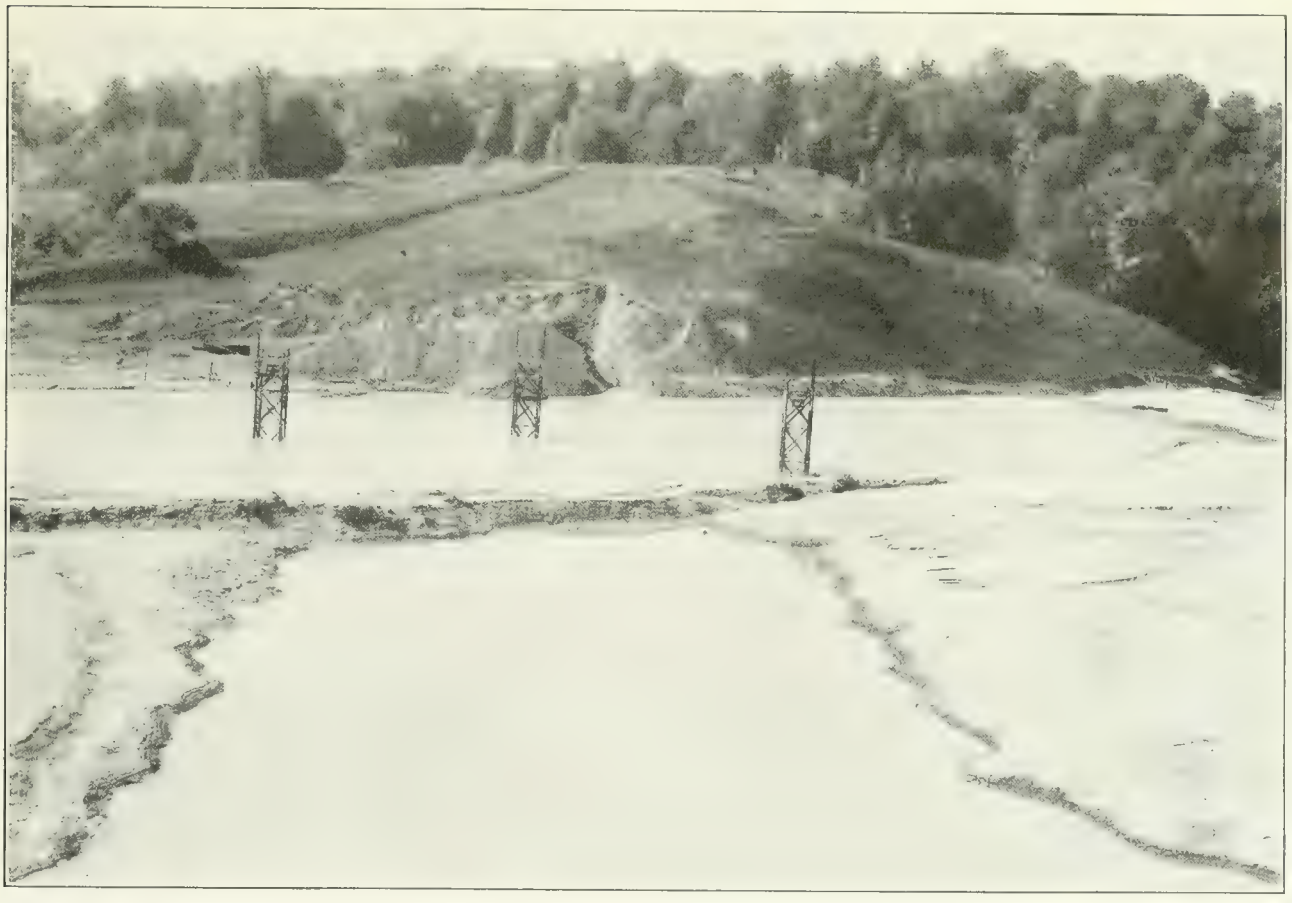

FIG. 117—PRESSURE CELL TOWERS AT THE GERMANTOWN DAM. SEPT. 15, 1919

The pressure cells described on page 140 are suspended from the tops of these towers, at intervals of ten feet for recording horizontal pressures, and at intervals of thirty feet for recording vertical pressures, the cells being imbedded in the earth of which the dam is built. The view is along the dam center line southward, the slope in the background being the south bank of Twin Creek. The core pool is seen in the center, (wider at its south end, which was temporarily separated from the rest by the dike). The gravel beaches, which build up into the retaining embankments of the dam core, are seen at each side. The core is of very fine clay and silt, deposited from the water in the pool. The towers are located near the center of the pool, and in the edges of the gravel beaches, so that the pressures can be obtained both in the core and in the enclosing embankments. (See Bulletin for February, 1920, page 105). The top row of diagrams in Fig. 119 were taken at the center tower; those in the lower row at the tower toward the left. Fig. 118 is a diagram of one of the cells. See pages 140 and 141. Picture taken Sept. 15, 1919.

Within a solid, however, while the downward pressure, as in a liquid, will be equal to the weight of the superincumbent unit column of the material, the sidewise pressure will only equal ¼ to ⅓ of this. If the same material becomes plastic—a stage intermediate between liquid and solid—its sidewise pressure also becomes intermediate between what it was as a solid, and what it would be if completely liquified, while its downward pressure would be the same, whether it were solid, plastic, or liquid. A stiff pudding, for instance, poured into an empty pail with a hole in its side, will "squash" out through the hole, due to the sidewise pressure in the pudding at that point. The thinner the pudding, the faster will be the flow; the stiffer the pudding, the slower the flow; giving proof that the sidewise pressure at the hole is greater the nearer the pudding comes to being a fluid, and less the nearer it comes to being a solid. Thus the ratio of the sidewise pressure in the pudding, at any point, to the downward pressure at the same point, will be a measure of the stiffness; that is, of the degree of solidification, of the pudding.

Now the degree of solidification is just what we wish to learn about our hydraulic fill core, because on this depends the safety against any possible sloughing out, such as may take place if the core is in too fluid a condition at considerable depths. To set then, a Goldbeck pressure cell in the core at any point, placed in a horizontal position, and another placed in a vertical position, and by means of these cells, measure the vertical and the horizontal pressures in the core at this point. The ratio of the two, as in the case of the pudding, will be a measure of the solidification which at this point the core has attained. Put such cells in the core, as the dam is built up, at regular intervals of depth, and take measurements of the pressures at all these depths, at regular intervals of time—say a month apart—and we shall have a complete history of the process of core solidification, from top to bottom, and throughout the entire period of the construction of the dam.

It was this application of the Goldbeck earth pressure cell which occurred to the Conservancy engineers on reading the experiments carried out by the U. S. Bureau of Public Roads and they proceeded to get in touch with the Bureau at Washington in reference to securing its co-operation in adapting the cells to use in the Conservancy dam cores.

The response of the Bureau was cordial, and several trips to Washington were made by the Assistant Chief Engineer for the District, Mr. Chas. H. Paul, to perfect the arrangements. Following the plans thus made, the Bureau conducted a preliminary investigation for the District (see Engineering News-Record, April 18, 1918) with pressure cells suspended in a 36-inch stand pipe 41 feet high, into which a mixture of clay and water was introduced, under conditions approximating those in the core of a hydraulic fill dam. The rate of deposition and solidification of the clay in the stand pipe bottom was studied, and the feasibility of applying pressure cells to the study of the dam cores themselves was thus demonstrated. The Bureau also sent Mr. Goldbeck, the originator of the cell, to Dayton, to co-operate in the installation of the apparatus in the dams.

The District also interested the U. S. Bureau of Soils at Washington, and secured their co-operation in an analysis of the core materials at the various Conservancy dams and a comparison between them and the core of the Calaveras dam.

A diagram of the pressure cell itself is shown in Fig. 118, exhibiting all the essential parts, in their relations to each other, more clearly than an actual cross section would do. In principle it is simple. It is to bury in the earth a hollow metallic disc, one

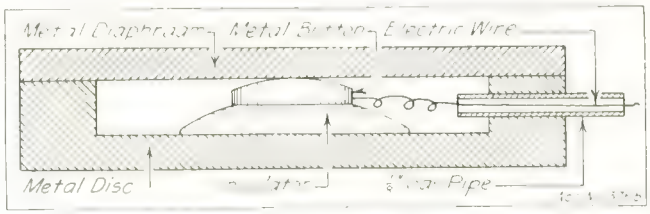

FIG. 118—GOLDBECK EARTH PRESSURE CELL

For greater clearness, this is shown as a diagram rather than as an exact cross section. The parts are indicated by the arrows. The cell is a hollow metallic disk, one face of which (top face above) is an elastic metal diaphragm. The cell is buried in the earth of the dam. The earth pressure keeps the diaphragm pressed against the rounded surface of the metal button, thus closing an electric circuit carried by wires to the top of the dam through a small air pipe, as shown. When a measurement is to be made, air is admitted into the hollow of the cell from a compressed air tank on top of the dam, thus balancing the earth pressure, till, just at equilibrium, the diaphragm is forced outward, breaking the electrical contact with the button. The break is indicated by the going out of a small electric indicator lamp in the circuit. The pressure is then read on an air gage connected with the air pipe line. **See page 140.**

face of which is a metal diaphragm, and to balance the earth pressure against the outside face of the diaphragm by air pressure against its inside face, the air being introduced into the hollow of the disc by means of a small pipe which is carried down through the earth from a compressed air tank on top of the dam. An air gage, built like a steam gage, and connected with the pipe running to the buried cell, measures the amount of the pressure. The detail of the working is shown in Fig. —.

The method of installation of the cells depends on the type of dam outlet structure. At Lockington, Taylorsville and Huffman, the outlets are carried between heavy retaining walls (the side walls of the spillway), which extend entirely through the earth embankment and up to its full height. At these dams the cells are supported on the back faces of these walls. At Germantown, and Englewood, where the spillway is a separate structure, and no such walls exist, the plan provides for supporting the cells on light wooden towers. Fig. 117 shows these towers at Germantown, there being three of them, one near the center line of the dam core, and one near each of its two faces. These towers are built up section by section as the material in the dam rises during construction. The pipes carrying the air pressure to the cells are suspended vertically from the tops of these towers, with an earth pressure cell at the bottom of each pipe. For the lateral pressures, cells are suspended at intervals of ten feet in depth, as the dam rises; for vertical pressures this interval is thirty feet, experience showing that the lateral (horizontal) pressures are the ones needing most careful watch. The compressed air tank, air gage, etc., are carried on a platform at the top of the tower. To permit a pressure cell to settle with the

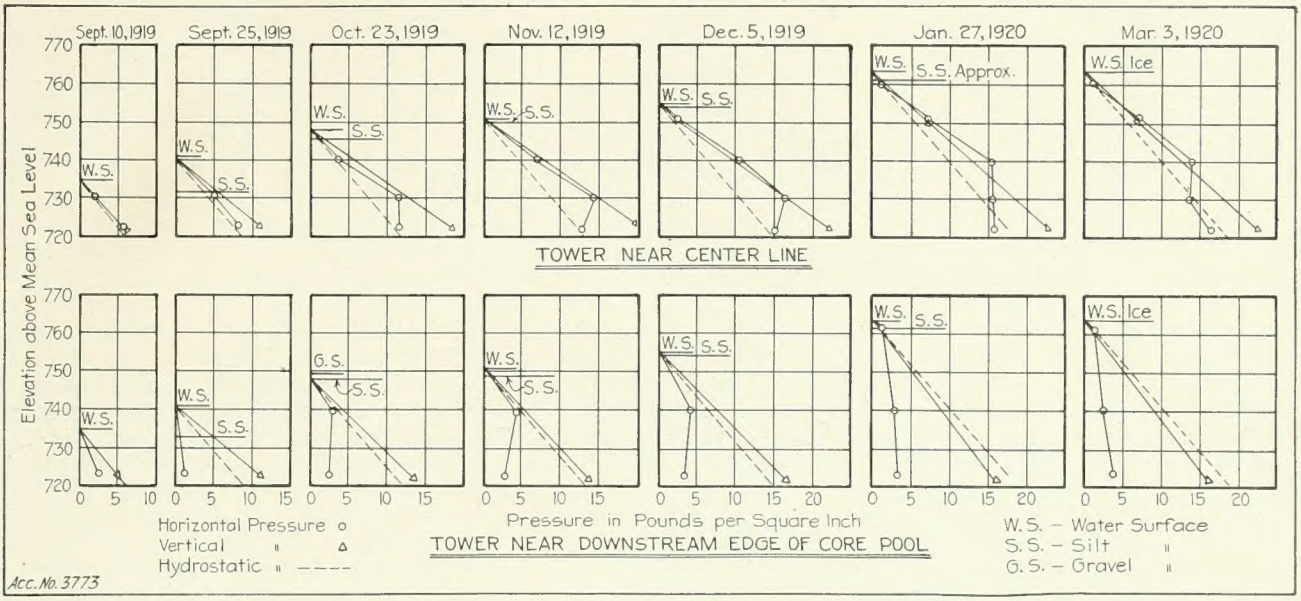

FIG. 119—DIAGRAMS OF EARTH PRESSURES, GERMANTOWN DAM. SEE PAGE 141

material in the core (as the mud in the bottom of the pool is consolidated by the steadily increasing pressure of the added material), each cell with its ascending air pipe is suspended by a wire running over a pulley at the top of the tower, the other end of the wire carrying a counterweight. The air tank and air gage are successively connected to the top of each pipe by a rubber hose and a valve, precisely in the manner of connecting an automobile tire to the air tank in a garage. Thus the pressure measurements for all the cells are rapidly and easily taken. Observations are made at monthly intervals.

For study and comparison the measurements are plotted on diagrams. The upper row of rectangles in Fig. 119 is a series of such diagrams for the cells at the tower near the dam center line at Germantown, the lower row of rectangles showing conditions at the tower in the gravel slope near the down stream edge of the core pool. Each rectangle gives the results of one full set of the monthly observations, the date being noted above the rectangle. Setting the diagrams thus side by side, the behavior of the dam core material, month by month, can be readily studied.

Each small circle and small triangle indicates a measurement on a pressure cell; the circle a horizontal pressure, the triangle a vertical pressure. The amount of the pressure is given by the distance of the circle or triangle from the left edge of the rectangle it is in, the successive vertical lines marking successive increments of five pounds pressure, as indicated by the figures 5, 10, etc., below the rectangle. The distance of the circle or triangle from the bottom of the rectangle indicates the distance of the measuring cell from the bottom of the dam, the successive horizontal lines marking ten-foot vertical intervals. (The figures at the left edge of the left diagrams give the elevation of these lines above sea level—720, 730, etc.) Thus the upper small circle in the left upper rectangle indicates that on September 10, 1919, there was a horizontal pressure of about 2 pounds per square inch in a cell on the center line tower 730 feet above sea level, or 4.5 feet below the level of the water in the core pool,, the latter being given by the short horizontal line on the same diagram marked "W. S." (Short horizontal lines marked "S. S." and "G. S." indicate respectively the level of the silt surface and the gravel surface at the bottom of the core pool). Near the bottom of the upper left rectangle the small circle and the small triangle practically coincide, showing that at the depth in the pool indicated, about 12 feet, the vertical and horizontal pressures were the same (about 6 pounds per square inch). This means that the mud at this point was still so thin that it behaved as a liquid slightly heavier than water.

The next rectangle in the upper row shows the condition at this tower on September 25, 15 days later. The water surface in the pool has risen to elevation 740.5. "S. S.," the silt surface, indicates that a distinct surface of mud at the pool bottom has formed about 9 feet below the water surface. The little triangle indicates a vertical pressure of about 11 pounds at a depth of about 18 feet in the pool, and the lower small circle indicates a lateral pressure of about 8 pounds at the same depth. The difference of three pounds indicates a stiffening of the mud at this depth, since if the mud were still thin enough to act as a liquid, the two pressures, lateral and vertical, would be equal.

The lowest circle and triangle in the next rectangle, showing the conditions a month later, October 23, show a marked and significant change in the core material. The lowest circle is directly below the next lowest, indicating that the additional depth of core deposited during this month, about 7 feet, has not made any addition to the horizontal pressure in the core material at the lowest pressure cell. At the same time the vertical pressure, at the same point, given by the little triangle, has risen from 11 to 18 pounds. The difference between the horizontal and vertical pressures at this point, the measure of the solidification of the materials, has risen there to about 6½ pounds. (Indicated by the horizontal distance between the lowest circle and the lowest triangle). This fits with the significant fact above noted, that the increase in depth of material has not

increased the horizontal pressure at the bottom of the dam (the level of the lowest small circle and small triangle readings). All the later diagrams tell a similar story—that below a depth of twenty to twenty-five feet, the horizontal pressure remains constant, although the depth of core material is steadily increasing, while at the same time the vertical pressure increases. Analysis, which cannot be given here, would seem to indicate that this means a sufficient stiffening of the core material such that if a cube of it were cut, several feet high, it would stand alone, like a piece of cheese. Explorations are in progress to ascertain by examination of the actual materials, whether this is the true state of affairs. If so, it will constitute an additional assurance in this important matter. In any case, there can be no doubt that the pressure cells have already proved their value in action and have indicated a condition of the core materials which is very satisfactory to the engineers in charge.

This is no less true of the materials in the sand and gravel retaining embankments, between which the core lies, as may be seen by an inspection of the lower row of rectangles, showing the conditions just outside the pool margin, where pressure cells have been imbedded in these materials. These embankments, as has been said, give weight and stability to the dam structure. They also, by their open, porous texture, permit free drainage of the water which slowly escapes sidewise and downward from the core. This is an important function, and the lower diagrams show that the porous materials are performing it in a highly satisfactory manner. The small circles show that the horizontal pressure at the bottom of the dam, in these materials, never exceeds 3½ pounds, although the water pressure alone, at the depth reached by the material in the last two digrams, would be about 19½ pounds, if the water were confined. At the same time, the vertical pressure, as indicated by the small triangle, is

MIAMI CONSERVANCY

INEXHAUSTIBLE FARMS
FOR SALE

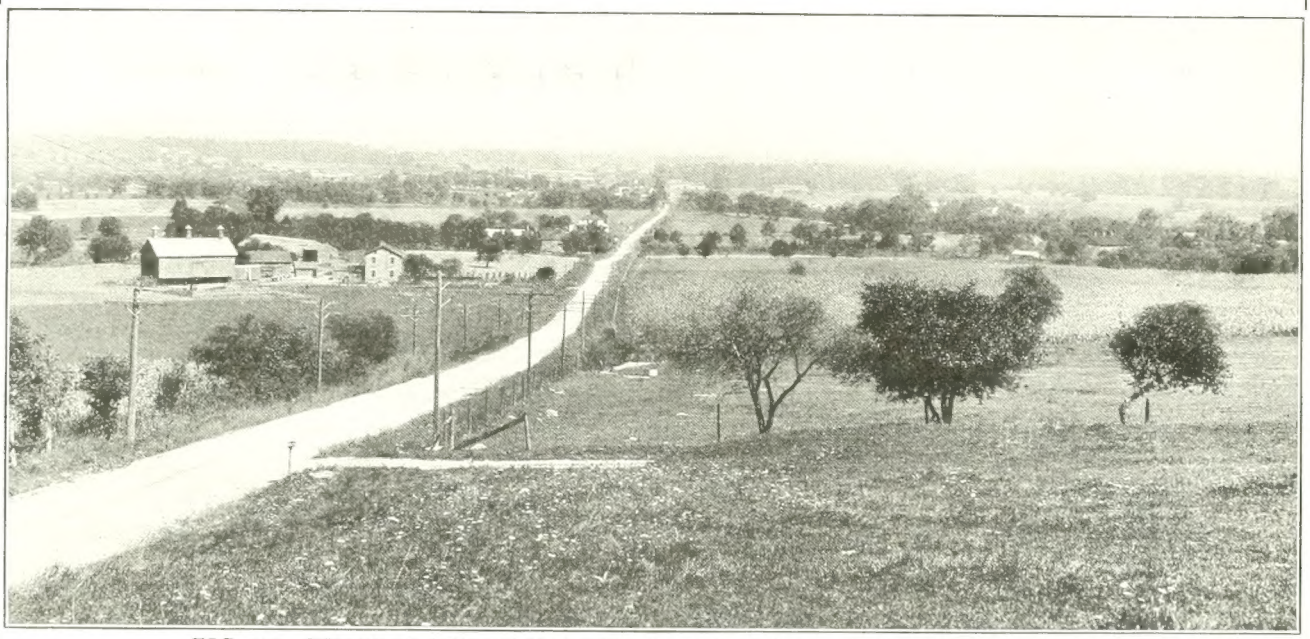

FIG. 120—TYPICAL MIAMI VALLEY FARM LANDS. TAKEN SEPT. 27, 1918

Rich Corn Farms, Kept Perpetually Fertile by Alluvial Deposits.
No Manure or Fertilizer Necessary.
No Pioneering—These Are Well-Improved, Going Farms.
In One of the Richest River Valleys of the Middle West.
Fourteen Steam and Electric Roads Run Through It.
Nine Flourishing Cities (Populations from 4,000 to 153,000) Furnish Near-by Markets.

Address Office "F"—Miami Conservancy District, Dayton, Ohio

being transmitted up to 16 pounds intensity. The desired porosity and stability of the sand and gravel next the impervious core are thus indicated.

Both in the core and in the retaining embankment, then, the pressure cells are doing their expected work in a satisfactory manner. This is the more gratifying, since the Conservancy dams are the first in which such cells have ever been applied to such a purpose; the first, in fact, in which any consistent attempt has been made to know, as the work goes on, just what happens to the core materials. With the nature of the results to date thus encouraging, the investigations will be pushed steadily forward, and there is little doubt that they will prove of high value, both to the work of the Conservancy and to all engineers who in the future will be confronted with the problem of the hydraulic fill dam. The cordial co-operation of the United States Government in this connection is especially gratifying, the independent observations of the government engineers giving a weight to the results which the public is certain to appreciate.

Concreting Layout at Taylorsville

The panorama on this page shows this layout in all its essential features. In the distance at the right is the dragline excavator (a transformed steam shovel), working in the gravel pit. The material, loaded into 12-yard air-dump cars, is brought across the river by 40-ton locomotives (via a switchback), to the gravel washer in the middle distance at the left. (For description of this, see Bulletin for April, 1919). Here the sand and gravel are washed and screened. The concrete mixing is done in the "basement" of the gravel washer, the cement being wheeled in barrows from the cement house seen just this side of the washer. The concrete is brought from the washer to the forms by the two 3-foot gauge tracks seen in the middle foreground, on platform cars drawn by gasoline locomotive, the concrete being held in 1¼-yard bottom dump buckets. These are picked up by one or the other of the two stiffleg derricks in the foreground, and the material dumped in the forms. The derrick booms are 90 feet in length, having been cut down from an original length of 105 feet for quicker speed.

The two concrete walls crossing the excavation are the upper and lower weirs of the stilling pool. The deep excavation in the right foreground is for the hydraulic jump pool.

(Continued from Page 136)

350 feet. (Giving 135 to 150 pounds per square inch). The erosive power of such a stream is very powerful, and results of corresponding efficiency in tearing down the earth in the Lockington borrow pit are expected. A 2½-inch stream has heretofore been used there. Water is supplied by two 10-inch centrifugal pumps "in series," direct-conected to alternating current motors. These pumps will sup-

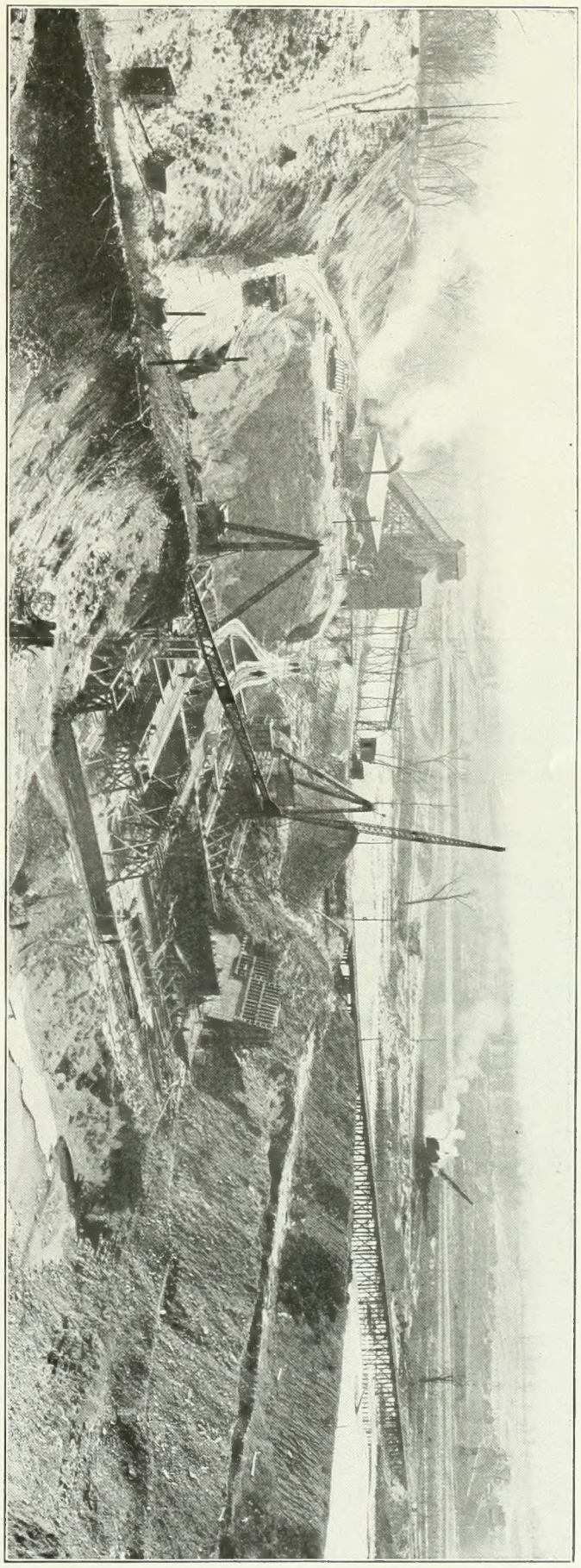

FIG. 121—CONCRETING LAYOUT AT TAYLORSVILLE DAM. TAKEN FEB. 5, 1920

ply 3500 gallons per minute. The upright post at the left end of the giant carries a beam, pivoted at its middle to the top of the post, and attached at its right-hand end to the stirrup piece shown mid-length of the "gun" barrel; the other end of the beam carrying a counterweight to balance the weight of the barrel and nozzle. These swing in a vertical plane on two bolts (one of which can be seen), to the right of the upright post. Water tightness is provided by a leather gasket riding on the spherical surface seen just to the left of the two flanges. Motion of the nozzle to right and left is provided by a ball bearing at the foot of the post, just above the flanges shown. A flat diaphragm gasket of leather provides water-tightness at this joint, the water pressure being made to force the ring of the gasket into contact with its cast iron seat, so that the greater the pressure, the firmer the ring seats. Projecting fins within the gun barrel, parallel with the bore, in two sets, three in a set, do the work of the rifling in a cannon to shoot the stream of water straight and true, so that it will emerge in a solid jet and not in a spiral scattering spray, as it otherwise tends to do. The howitzer-like piece, the "deflector," carried at the end of the barrel (on two trunnions at right angles, constituting a universal joint), compels the jet to do the mechanical labor of aiming itself. By turning it to right or left, or up or down, by means of rods running back to the breech, the emerging water jet is made to strike the bore of the deflector, thus forcing the latter in any direction desired. The necessity of some such device will be clear on a consideration of the fact that the total pressure between the "gooseneck" and the "bowl," (at the foot of the vertical post), under working conditions, is about 3,000 pounds.

USED STEEL BRIDGES AND OTHER RAILWAY MATERIAL FOR SALE

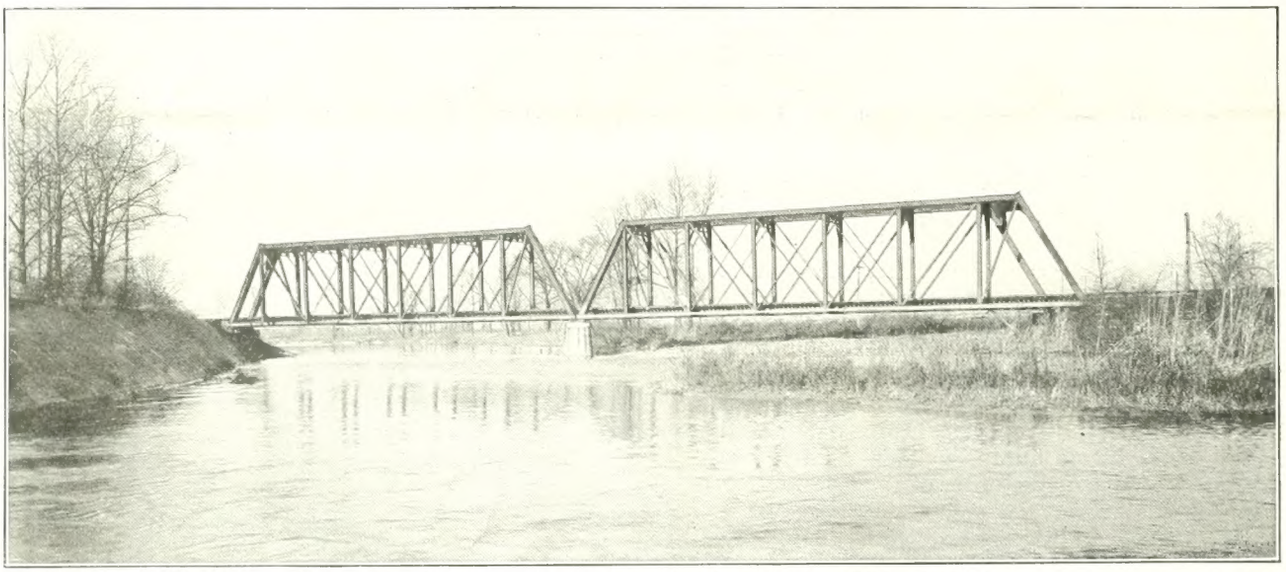

FIG. 122—ERIE RAILWAY BRIDGE OVER MAD RIVER

5 Single Track Truss Bridge Spans 136 Feet to 154 Feet.
7 Through Girder Bridge Spans 23 Feet to 100 Feet.
10 Deck Girder Bridge Spans 22 Feet to 45 Feet.
72 I-Beams (15 to 24 inches,) Lengths Up to 20 Feet.
(All the above in use 5 to 15 years on important lines.)

3100 Tons 90-Pound Main-Line Steel Rail. (In use 5 to 12 years.)
658 Tons 80-Pound to 90-Pound Passing Track and Siding Rail.
A Large Quantity of Ties, Switches, Special Joints, Angle Bars, Spikes, Track Bolts, Frogs, etc., etc., Used in the Above Track.
All in Good Condition. Bridges Applicable to Railways, Electric Railways, or Highways. An Excellent Opportunity to Buy.

Address Dept. "X" Miami Conservancy District, Dayton, Ohio